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file P-196

RAK

MONTHLY PROGRESS REPORT #3

on the

TERRAIN AVOIDANCE RADAR SYSTEM

For the period from

31 July to 31 August 1957

WESTINGHOUSE REFERENCE

G.O. AAD-30465

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PROGRESS FROM 31 JULY TO 31 AUGUST 1957

ANTENNA:

The feasibility of scanning 30° with horn feed scanning has been proven. A simple horn design has been worked out which will be easy to fabricate. A breadboard model was built and the pattern checked over the desired scan sector. It appears entirely satisfactory. This was a flat model requiring a reciprocating feed scan. A rolled-up model suitable for rotary feed scan motion is now being fabricated in the Model Shop. A paper design for the high-speed rotary joint has been completed and a model is now being constructed in the Model Shop.

R. F. HEAD:

Based on an antenna configuration as presently envisioned, a R. F. Head layout has been worked out. Suitable mounting and positioning means have been devised which minimize radome frontal area.

TRANSMITTER:

The transmitter mounts on the back of the antenna and includes the pre-amp and AFC. Since it must be closely coordinated with the antenna mounting assembly, detail design cannot be completed until this is known. A tentative layout suitable to the R.F. Head as presently envisioned has been made up. Two magnetrons have been received. The first did not produce adequate power output. The second one ceased to function after about 10 minutes of operation. Delivery of these magnetrons was slow because the manufacturer has been having trouble with the cathode assembly. In order not to be totally dependent on this magnetron, an investigation is being made of the feasibility of using the 6799 magnetron under conditions suitable to this project.

MODULATOR:

The modulator design has been completed. A detailed layout has been made. Drafting will be started when the design has been checked out with a magnetron. If the 6799 magnetron is used a new modulator must be designed.

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The pre-amplifier breadboard construction is finished and preliminary performance tests completed. The new layout seems to work out very well electrically and mechanically.

The bandwidth is 6 mcs, gain is approximately 50 db, with a system noise figure of less than 12 db with four of the six reversed matched pairs of crystals tested.

The output stage of the pre-amp was changed from the "pentode line matching type" to a bifilar stepdown transformer. The primary reason being that the first method does not have a simple controllable resonance curve. The stepdown transformer does have a simple resonance curve and also has a larger gain bandwidth product.

Much difficulty was experienced with the I.F. noise figure measuring setup with the conclusion that the absolute value of I.F. noise figure not being known. This can be determined by more elaborate calibration of the test equipment.

The post-amplifier breadboard construction is approximately 50% complete.

AFC:

The AFC design has been completed and checked out. Drafting is now in progress.

"E" SCOPE:

The "E" scope was designed and bench tested without an indicator tube. A complete breadboard for the system bench test was built and certain changes, brought about by system philosophy changes, incorporated. A CRT was received and incorporated also. Some modification of driver circuits was found to be necessary. Bench tests are now 95% complete. A complete schematic and general layout are now being prepared for submission to drafting.

"X" SCOPE:

The "X" scope was designed and tested without an indicator tube. A complete breadboard for the system bench test has been built, but testing has not been started.

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The storage CRT has been received and will be incorporated as soon as a socket is received. Since this is a new tube and certain information is not too well established, some circuit modifications will probably be necessary. A design for the optical system has been worked out and an order placed with Bausch and Lomb. They demonstrated a bench model which appeared to present a satisfactory image. A complete schematic has been started and a general layout planned. Some work has been done on a detailed layout.

POWER SUPPLY:

The power supply cannot be completed until the requirements of the system are established. The supply voltages have been selected and regulator circuits designed and bench tested. A complete breadboard has been started. A standard regulator amplifier has been designed to be used with all supply voltages and a plug-in package design completed. Conventional regulated power supplies drift with temperature. The commonly used VR tube reference has a voltage that varies appreciably with temperature and current. The slow scans involved in this system require direct-coupled deflection circuits and the optical mixing of images requires extremely drift-free displays. Zener diodes are used as the voltage reference in the power supply since they are less sensitive to temperature ($.01\%/^{\circ}\text{C}$) and the voltage is more nearly constant with current variation than is the case with VR tubes. High-gain amplifiers are used to obtain good regulation and low hum levels. To achieve stability that will produce a negligible effect on the "X" scope image it is necessary to enclose the first amplifier and zener diodes in an oven. Small plug-in ovens will be used.

ANTENNA SERVO:

The requirements of the antenna servo and its relation to the aircraft system have been worked out. A repeater must be installed to pick off roll or bank angle from the N-1 compass system. It has been determined that a wind computer is not included in the doppler radar so that when the aircraft banks and exceeds

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the angle for which the doppler is stabilized, it becomes impossible to obtain useful doppler data. The wind computer is needed to take over at this time and use air-speed, heading and last known wind condition to compute ground speed and drift angle. Drift angle is utilized by the terrain avoidance radar to orient the antenna along the ground track. At a recent meeting of General Precision Laboratory (the doppler manufacturer), Westinghouse and a representative of the customer, GPL disclosed a lightweight wind computer which they have in an advanced state of development at their own expense. It was decided that Westinghouse should sub-contract with GPL for production design and delivery of a prototype to the project. We are awaiting information from the aircraft people regarding wing motion so that we can determine if an additional gyro reference must be placed in the pod housing the antenna so that this motion can be taken into consideration by the antenna servo.

CONTROL PANEL:

Design of the control panel has been started. The functions have been worked out and a panel layout made.

FUTURE ACTIVITIES:

During the next month design and breadboard testing will continue. A prototype antenna feed horn and high-speed rotary joint will be tested. Efforts to secure a satisfactory magnetron will continue.

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